Welcome to 20.109
Laboratory Fundamentals of Biological Engineering

Orientation Lecture
Fall 2007

20.109 Laboratory Fundamentals of Biological Engineering

Course Mission
➢ To prepare students to be the future of Biological Engineering
➢ To teach cutting edge research skill and technology through an authentic research experience
➢ To inspire rigorous data analysis and its thoughtful communication

Module 1  Genome Engineering
Module 2  Expression Engineering
Module 3  Biomaterials Engineering
Genome Engineering: M13 redesign

Expression Engineering: siRNA

Biomaterial Engineering: phage nanowires

Experiments                      Lab skills
Modify existing genome to tag one coat protein DNA manipulations
• digests
• transformation
• electrophoresis

Refactor genome, order its synthesis and test Western analysis
• visualization

Compare infection of minimal and robust E. coli genome Cell & phage culture

Silence expression of a gene using genetic and physical manipulations
RNA
• siRNA design
• transfection
• RNA and protein measurements

Assess intended and unintended consequences Microarray analysis

Build prototype electrochromic device Phage material production
• growth
• pattern indium tin oxide slide TEM
• electrodeposition phage nanowires fabrication of bio-based device
• overlay solid polymer electrolytes design and variation of experimental conditions

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State-of-the-Art Laboratory Classroom
Space for 12 students • Demonstration Area • 20 Computer Drops
• Gas/Vacuum/Air/Water • Modern Equipment •

Cell and Tissue Culture Facility
HEPA Filtered Air • 3 Sterile Hoods • 6 incubators • 2 inverted microscopes • Modern Culture Equipment

Support Room
Autoclave • Dishwasher • Ice Machine
• CO₂ Source • Vacuum Source
Course Details

Lecture: Tuesdays and Thursdays 11-12
Lab: Tuesdays and Thursdays 1-5
Wednesdays and Fridays 1-5

There are no “make-up” labs

Work must be turned in on time
- Lab reports, homework: at beginning of lab
- Lab notebook pages: at end of lab

You will perform experiments in pairs
Assignments can be worked on together but submitted individually

Grading

50% Written Work  Modules 1 and 2
30% Oral Presentations  Modules (1 or 2) and 3
10% Homework Assignments
5% Daily Lab Quizzes
5% Lab Notebooks

Foundations/Skills

- Basic Laboratory Skills
  - following and designing protocols
  - first-hand experience with equipment and procedures
  - how to keep a lab notebook
- Robust Quantitative Analysis of Data
  - statistical analysis when appropriate
  - repetition of protocols to assess quality of findings
  - effect of experimental perturbations on outcome
- Verbal and Written Communication
  - two oral presentations
  - two written reports
- Critical Thinking
  - Analysis and discussion of primary scientific literature